

## Research Brief

### **The Potential Impact in New Home Affordability If Fire Suppression Sprinklers Are Added to All New Single Family Homes**

An Analysis Conducted by Dr. Scott Rickard, Director, Center for Applied Economic Research, Montana State University Billings

January 27, 2011

#### Overview

This analysis estimates the potential reduction in affordability of newly-constructed homes caused by a proposed change in the construction requirements for single-family homes built in Montana. It used a regulatory impact model built by the Center for Applied Economic Research (CAER) at Montana State University Billings on behalf of the Montana Association of REALTORS®. This model uses the housing characteristics and pricing data from a number of local REALTOR® associations' Multiple Listing Services (MLS) databases and aggregated household income information from the Montana Department of Revenue (MDOR) to estimate the potential change in average sale price for a home sold in Montana after this change and then estimate the number of Montana households that could no longer afford a home of a given size due to the increase in sales price due to this change.

#### Regulatory Incidence and Regulatory Burden

The economic impact of a regulatory change which changes the price levels for a good or service depends upon which economic actor this change directly affects and this actor's ability to pass some or all of this change to other actors who together make up the industry or regional economy in which they all participate and live. Take the case of a home builder who is facing a regulatory change in how homes must be constructed. This change will increase construction costs. If the builder cannot pass along any of this cost increase to the buyers of his homes, he will pay for this increase out of his profits, and the builder will represent both the regulatory incidence and burden. At a lower profit margin per home, he will need to build more homes per year to earn the same total profit each year. If there are not available buyers for additional homes, he will either have to accept a lower home-building income per year or quit building homes in Montana.

At the other extreme is a builder who can pass along the entire cost of the regulatory change to the buyers of new homes. The builder has no reason to change the number or types of homes

he constructs, because he has completely shifted the cost burden of this regulation to the home buyer. The home buyer, on the other hand, is now paying for these changes which he may or may not actually value. (Most of us who have attempted to purchase a home can remember a home tour where a feature of the home is pointed out as being valuable but has no value to us.) The buyer now has less money available to spend on other things.

Between these two extremes there are degrees of burden shifting depending upon the builder's ability to share some part of the increased costs due to this regulatory change with either the buyer of his new homes or the contractors or suppliers who he pays to build them. It is possible that several of the economic actors in this process will share the cost burden. Drywall contractors could be forced to accept a lower wage for the job. Some home buyers will accept the higher price while others with less budget flexibility will be forced to build a smaller house and others will no longer be able or willing to buy a new home at all. The builder will make a lower profit margin per home and less profit per year. Overall, the size of the home building market in Montana will likely decline<sup>1</sup>.

### The Regulatory Impact Model

The Regulatory Impact Model (RIM) consists of three components:

- A model predicting the sale price of a home with given characteristics located in various parts of Montana,
- An algorithm estimating the income necessary to afford a house of that price,
- And a model estimating the number of Montana households with adjusted gross incomes above the necessary level to afford the estimated mortgage payments for this home.

The estimate of the sale price for the home is based upon the homes sold in Montana by REALTORS® using the local area's MLS. The MLS contains information on the characteristics of homes listed for sale and data on the sale prices of those homes sold. Using this data, analysts at the CAER constructed hedonic models which estimate the dollar value that Montana homebuyers place upon different levels of housing characteristics. More specifically, this model estimates how much more on average buyers paid for an additional bathroom or for a new home compared to an existing home of average age. The MLS data covers sales as recent as November 2010. These models are region-specific and cover most of the populated counties in Montana (those with MLS systems).

Using the appropriate model, a scenario can be run where assumptions about home characteristics are used to estimate the sale price for a given type of home. If the goal is to estimate the change in price due to changes in home characteristics, one of two methods can be used. If what is changing is something that the model captures (such as a change in lot size),

the model can directly estimate the new price given the change. If what is changing is something not directly modeled (a feature that either is not described in the MLS or one that the statistical tools used could not determine to be a significant driver of price because of such things as too few sales in this area), an outside-the-model estimate of how this change would affect average sale price can be used and this change added directly to the initial price estimate.

The second step of the RIM is to estimate the household income and asset requirements needed to purchase a house with this price. This estimate is made using prevailing interest rates and mortgage loan terms and standard credit scoring ratio cut-offs such as maximum debt to income levels. As recently as three years ago these assumptions would have been more of a problem given the wide range of loan types available, but current conditions are such that it is safe to assume that a 30-year, fixed-rate mortgage is the standard. The assumptions used in each RIM model run are presented at the end of this analysis.

The third piece of the RIM is a model estimating the number and percentage of Montana taxpayers who could afford a mortgage loan of the estimated size. This model is based upon aggregated data received by the MDOR. The MDOR provided tables listing the number of in-state taxpayers reporting 2009 adjusted gross incomes in different income ranges (an example is included at the end of this document) for the state as a whole and the most populated counties.

With these tables alone, it was possible to examine gross changes in income, but they were not detailed enough to identify changes of a few percentage points and any estimate of the number of households carried with it an uncertainty of plus or minus three or more percentage points. The RIM needed additional detail. To get this, using the information contained in the MDOR tables, the CAER used statistical tools to estimate what a more detailed table would most likely have looked like. The end result is that the RIM model can estimate the change in the number of households who can still afford a home of a given size after an estimated price change to a much finer detail.

### **The Analysis**

The goal of this analysis was to estimate the impact of a regulatory change which would require new homes constructed in Montana to be equipped with fire-suppression sprinkler systems. The home characteristics database used in the RIM did not include this information and the price model did not directly estimate this characteristic. Instead, an outside estimate of the additional costs of adding sprinklers to new construction was calculated. This estimate was based in part upon a 2007 study conducted on behalf of the National Association of Home Builders concerning the costs of installing sprinklers. To adjust for both differences in prices between 2007 and now and between national averages and what Montana builders would pay,

we chose a low-end estimate of \$6,000 as the builder costs for adding sprinklers during the construction of a new home.

There may also be additional cost due to impact fees levied by the taxing jurisdiction where the house is constructed. These fees are typically based upon the size of the water supply line feeding the new home. Sprinklers typically require the builder to use one-inch supply lines or larger rather than the standard ¾ inch supply line. The estimated size of these fees ranged from \$6,000 to \$18,000. In this analysis, an upper-bound estimate of \$24,000 in additional costs is used to capture both the construction and potential impact fee costs of adding sprinklers to all new home construction.

Using the RIM database of housing characteristics and sale prices, the following are the median prices and counts of new homes sold in several populated areas of Montana in the past few years:

Table 1 Prices and Characteristics of New Homes Built Within Past Few Years

County	Time Span	Avg. SQFT	# Sales	Median Price
Yellowstone	2009-2010	2,149	127	\$205,129
Gallatin	2009-2010	2,019	65	\$237,000
Great Falls	2010	2,474	53	\$232,900
Flathead*	2009	1,745	25	\$192,000

Several other areas did not contain sufficient data to be included in these calculations. In the case of Flathead County, listing price was used because sales prices were not available.

From this the baseline and estimated prices of comparable sprinkler-equipped new homes are as follows:

Table 2 Estimate Median Prices of New Homes without and with Sprinklers (and Impact Fees)

	Median Price without Sprinklers	Median Price with Lower-Bound Est. of Costs	Median Price with Upper-Bound Est. of Costs
Yellowstone	\$205,129	\$ 211,129	\$ 229,129
Gallatin	\$237,000	\$ 243,000	\$ 261,000
Great Falls	\$232,900	\$ 238,900	\$ 256,900
Flathead*	\$192,000	\$ 198,000	\$ 216,000

Using this information, the RIM model was used to calculate the necessary income and down payments needed to purchase the baseline and comparable sprinkler-equipped new home.

Table 3 Estimate Homeowner Costs and Income Requirements for Purchasing an Average-Sized New Home, Without vs. With Sprinklers

	Base	Sprinkler	Sprinkler + Impact Fees
<b>Yellowstone</b>			
Price	\$ 205,129	\$ 211,129	\$ 229,129
At Closing	\$ 44,513	\$ 45,815	\$ 49,721
Monthly Payments	\$ 1,052	\$ 1,083	\$ 1,175
Annual Income	\$ 45,081	\$ 46,399	\$ 50,355
Difference in Closing Cost		\$ 1,302	\$ 5,208
Difference in Annual Payments		\$ 369	\$ 1,477
<b>Gallatin</b>			
Price	\$ 237,000	\$ 243,000	\$ 261,000
At Closing	\$ 51,429	\$ 52,731	\$ 56,637
Monthly Payments	\$ 1,215	\$ 1,246	\$ 1,338
Annual Income	\$ 52,085	\$ 55,779	\$ 58,417
Difference in Closing Cost		\$ 1,302	\$ 5,208
Difference in Annual Payments		\$ 369	\$ 1,477
<b>Cascade</b>			
Price	\$ 232,900	\$ 238,900	\$ 256,900
At Closing	\$ 50,539	\$ 51,841	\$ 55,747
Monthly Payments	\$ 1,194	\$ 1,225	\$ 1,317
Annual Income	\$ 53,034	\$ 54,187	\$ 56,824
Difference in Closing Cost		\$ 1,302	\$ 5,208
Difference in Annual Payments		\$ 369	\$ 1,477
<b>Flathead</b>			
Price	\$ 192,000	\$ 198,000	\$ 216,000
At Closing	\$ 41,664	\$ 42,966	\$ 46,872
Monthly Payments	\$ 985	\$ 1,015	\$ 1,108
Annual Income	\$ 42,195	\$ 43,514	\$ 47,470
Difference in Closing Cost		\$ 1,302	\$ 5,208
Difference in Annual Payments		\$ 369	\$ 1,477

As shown in this table, at the time of purchase, a buyer of a median-priced new home that contains a fire suppression sprinkler system which adds between \$6,000 and \$24,000 to home costs could spend between \$1,302 and \$5,208 in additional closing costs. These purchasers would also spend between \$369 and \$1,477 per year in additional mortgage payments.

With these income estimates, the number and percentage of households at or above this income level in each county were estimated using that module of the RIM. Note that these estimates assume that these households can fund the additional closing costs out of savings. For the comparison between no sprinklers and mandatory sprinklers, the results are as follows:

Table 4 Percentage of County Households Who Could Afford Average New Home without and with Sprinklers

County	# of HHs Than Can Afford Median P New Home without Sprinklers	# HHs Losing Affordability due to Sprinkler Costs (Lower-Bound Estimate)	# HHs Losing Affordability due to Sprinkler Costs (Upper-Bound Estimate)	% Maximum Reduction in Local Market for New Homes
Yellowstone	35,452 (53%)	598	2,398	7%
Gallatin	18,234 (48%)	939	1,605	9%
Cascade	14,730 (43%)	300	980	7%
Flathead	19,067 (52%)	364	1,454	8%

In the four counties modeled in this analysis, it is estimated that the additional costs of installing fire suppression sprinklers in new homes could reduce the share of households who could afford a median-priced new home by up to nine percent (9%). This would represent between 2,200 and 6,400 households.

### Conclusions

An analysis of the potential impacts of requiring all new homes constructed in Montana to be equipped with fire-suppression sprinklers produced estimates of the upper-bound impact to the local market for new home. Based upon this analysis, a requirement that new homes be constructed with fire suppression sprinklers could reduce the number of local households which could afford a median-priced new home between 7% and 9% of all households in the four counties modeled, representing between 2,200 and 6,400 households.

For those buyers who still chose to purchase a new home of average size could see closing costs increase by between \$1,300 and \$5,200, and monthly payments increase by \$369 - \$1,477 per year.

## Appendix

The following information was used in this research. It is presented here to preserve the flow of the report.

Table 5 Median Costs of Adding Sprinkler Systems to a New Home, 2007 National Estimates

<b>Median Costs Associated with Sprinkler Systems (2007)</b>	
<b>Installation Cost</b>	<b>\$3,744</b>
<b>Fire Sprinkler Permit Fee</b>	<b>\$198</b>
<b>Fire Sprinkler Design Fee</b>	<b>\$593</b>
<b>RFS Water Service Pipe Changes</b>	<b>\$866</b>
<b>RFS Water Meter Changes</b>	<b>\$172</b>
<b>Total Cost to Builder</b>	<b>\$5,573</b>

The following assumptions were used in calculating the income needed to afford a mortgage loan of any given size:

<b>Mortgage Loan Assumptions</b>	
<b>Percent Down Payment</b>	<b>20%</b>
<b>Percentage Closing Costs</b>	<b>1.7%</b>
<b>Percent Insurance and Tax Escrow</b>	<b>1%</b>
<b>Interest Rate</b>	<b>5%</b>
<b>Payment Period (in Years)</b>	<b>30</b>
<b>Percent Max Debt Repayment</b>	<b>33%</b>
<b>Percent Max Housing Expenses</b>	<b>28%</b>

<sup>1</sup> There is, of course, the possibility that a regulation making some types of home features mandatory will lower the average costs of adding these features and make them more affordable to those home buyers who desire this feature. In this case, those buyers who wanted this feature and would have paid even more than necessary for it will be getting a good deal (which economists call consumer surplus) and the sum of all of this "willingness-to-pay" may be larger than the costs borne by the other buyers who don't value the feature but pay it because it is bundled into the price of the house, which overall they do value. An economic argument can be made that if the regulatory change doesn't discourage anyone from buying a home and results in more consumer surplus than before the regulation, it is a better outcome. However, the home buyers who don't value the feature but are forced to pay for it are rarely convinced of this.



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## **HB 307 Prohibit building codes from requiring some mandatory sprinkler systems**

**Sponsor: Rep. Tom Burnett**

**Hearing: Mar. 3, 9 a.m., Rm. 303, Senate Business and Labor**

Testimony: Glenn Oppel, Government Affairs Director, 431-3685, [goppel@montanarealtors.org](mailto:goppel@montanarealtors.org)

### **COST IMPACT OF SPRINKLER INSTALLATION ON NEW HOMES IN FOUR MAJOR AREAS OF MONTANA**

Compiled by MSU-Billings Center for Applied Economic Research

#### **Regulatory Impact Model (RIM) Analysis**

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